Appendix D

Summary of Department of Defense Petroleum Hydrocarbon Cleanup Demonstration Program Sites

Table D-1. Summary of Department of Defense Petroleum Hydrocarbon Cleanup Program sites.

Site name	Hydrogeologic setting	Exposure: Primary source and residual hydrocarbons	Exposure: Potential pathways	Exposure: Potential receptors	Key issues	Risk assessment findings	Recommendations	References
Barstow Marine Corps Logistic Center Tank 325	Mojave Desert alluvial setting: sands, gravels, silts, clay. No coherent bedding, extending hundreds of feet deep. Depth to water about 30 ft.	Leak from diesel UST as part of a waste water treatment plant. Approximately 20,000 gal diesel released. Residual free product in smear zone near surface of the water table.	Dissolved TPH-Diesel hydrocarbons extend about 600 ft downgradient. Plume relatively young. Off-site private well approximately one mile downgradient.	No existing receptors have been identified.	Where did 20,000 gallons of diesel go? What are seasonal changes in groundwater flow direction? How long will plume extend before it stabilizes? Is there any reasonable anticipated benefical use of groundwater?	Plume stability data not available. Plume is still young so it may still be growing. Facility will continue to be used as waste water treatment plant with associated sludge ponds. Secondary evidence of passive biodegradation of petroleum hydrocarbons. Strong biological activity in the subsurface environment due to waste treatment recharge.	• Additional monitoring point to verify plume stability. • Monitored natural attenuation. • Institutional controls to protect potential future receptors.	Pelmulder et al., 1998
Camp Pendleton Marine Corps Base Area 43	Unconsolidated fill and alluvium-sand, clayey silt. Depth to groundwater is 15 ft; clay aquitard about 4 ft thick. Creek is about 100 ft from release location; most likely is a gaining stream. Slow groundwater flow velocities—0.5 ft/day.	Former underground fuel tanks and piping at base service station. Unknown quantity of gasoline released. No residual hydrocarbons identified in soils.	Dissolved BTEX groundwater plume possibly truncated by nearby creek. MTBE detected in vicinity of UST locations. MTBE plume smaller than BTEX plume.	No existing human receptors have been identified. Potential to impact creek ecosystem and endangered bird: Least Bell's Vireo.	What are impacts to creek habitat and endangered bird?	Installation of monitoring wells in creek will be destructive of ecosystem. Stream sediment sampling indicate no BTEX compounds. Strong secondary evidence of passive bioremediation of BTEX compounds; Benzene likely to degrade before reaching creek. Endangered bird species is already part of base wide monitoring program. Aquitards prevent impact to regional aquifers.	• Additional monitoring to verify plume concentrations stability or decline. • Monitored natural attenuation with possible passive soil venting. • Institutional controls to protect potential future receptors.	McNab et al., 1998a

Table D-1. (Continued)

Site name	Hydrogeologic setting	Exposure: Primary source and residual hydrocarbons	Exposure: Potential pathways	Exposure: Potential receptors	Key issues	Risk assessment findings	Recommendations	References
Castle Airport (Former Castle AFB) POL Yard	Central Valley fluvial sediments; predominantly sands and silts. Fuel Farm is largely paved. Groundwater depth is 60 ft, but was as high as 20 ft bgs within last 50 yr. Groundwater velocity is high, about 3 ft/day.	Above ground storage tanks, underground storage tanks, rail head piping and pumping stations in operation since 1940's. Unknown quantities of diesel, gasoline, jet fuels released. Soil sampling indicates comparatively low concentrations of FHCs. Releases possibly small in volume or slow in rate; unusual for this type of facility. Soil gas data indicate explosive concentrations present over larger area than soil or groundwater data would indicate. No free product detected.	Two benzene plumes each less than 200 ft long.	No existing receptors have been identified.	What is the source of high concentration soil vapors? Closing base: base to be converted to public airport; future use of POL facility uncertain. What is the time frame for anticipated use of groundwater?	Dissolved BTEX and chlorinated solvent groundwater concentrations in excess of MCLs. Groundwater extraction system in place to cleanup nearby dissolved TCE groundwater plume will capture and treat any petroleum impacted groundwater.	• Determine integrity of existing above ground storage tanks and transfer lines. • Evaluate vadose zone treatment options of bioventing and soil vapor extraction.	Johnson et al., 1998
China Lake Naval Weapons Center Navy Exchange Gas Station	Mojave Desert alluvial setting. Clay aquitards underlies the site. Depth to water about 30 ft. High groundwater flow velocities, about 1 ft/day. Shallow groundwater of poor quality, >1,200 mg/L TDS.	Uncapped pressurized fuel line 1967–1993. Unknown quantity of gasoline released. Significant residual hydrocarbons extending about 1,100 ft from point of release. No free product currently observed, but groundwater TPH-g concentrations near solubility limit.	Soil gas and groundwater are the primary transport pathways. No ingestion pathway likely. Long benzene and MTBE plumes that are not stable, > 1,600 ft long. MTBE plume has migrated beyond BTEX plume.	No existing receptors have been identified. Receptors for possible inhalation impacts include residents, students, and workers. The aquifer will not likely be used for potable use due to high TDS (1,200 mg/L).	How long will plume extend before it stabilizes? What are vapor impacts to near by School? What is causing change in plume direction? Is there any reasonable anticipated beneficial use of the groundwater?	BTEX plume concentrations are declining. Secondary evidence of passive biodegradation of petroleum hydrocarbons. MTBE plume will stabilize through dispersion. No existing receptors have been identified; Inhalation pathway analyzed. Time to cleanup key technical issue. Aquitards prevent impact to regional aquifers.	• Install and additional monitoring well to define BTEX/MTBE plumes. • Additional monitoring to verify BTEX/MTBE plumes stability. • Active remediation to stabilize BTEX/MTBE plume migration, then monitored natural attenuation. • Institutional controls to protect potential future receptors.	Kavanaugh et al., 1998a

Table D-1. (Continued)

Site name	Hydrogeologic setting	Exposure: Primary source and residual hydrocarbons	Exposure: Potential pathways	Exposure: Potential receptors	Key issues	Risk assessment findings	Recommendations	References
El Toro Marine Corps Air Station Tanks 390A/B	Alluvial fan deposits of silts and clays with interbedded sands and gravels. Depth to groundwater: 150 ft.	Former underground fuel tanks and piping at base service station. Unknown quantity of gasoline, diesel, and JP-4/JP-5 released at various times. Over excavation performed during tank removal. No free product observed. Minor concentrations of residual hydrocarbons in soils.	Soil samples indicate that fuel hydrocarbons have not migrated to the water table.	No existing receptors have been identified. Nearest down gradient agricultural well is two miles distant.	What are potential impacts to groundwater of the residual fuel hydrocarbons in the soil?	Deepest residual hydrocarbons in soils are at 110 ft. Groundwater monitor wells have been installed and no fuel hydrocarbons found.	• Prepare documents to request no further action at this site.	Kavanaugh et al., 1998b
George Air Force Base Operable Unit 2	Unconsolidated alluvium in arid climatic setting. Perched unconfined aquifer 125–200 ft below ground surface.	Leaks from former Aviation Fueling pits and piping system. Unknown quantity of aviation jet fuel released. Estimated 350,000 gal of separate phase JP-4 aviation fuel on perched aquifer. About 160 gal of free product per day removed (32,000 gal to date).	No existing receptors have been identified. Stable plume length. Dissolved benzene plume about 1,200 ft beyond margin of free product.	No existing receptors have been identified.	How long will source persist? What natural process are depleting the residual hydrocarbons? How much of the residual hydrocarbons can be removed? What are the hazards of the remaining residual hydrocarbons? Time to cleanup key technical issue; land use planning is uncertain beyond 50 yr.	Significant residual hydrocarbons will persist for decades. Free product recovery efforts will not likely be effective; estimate 30% free- product removal optimistic. Passive biodegradation is likely limiting dissolved hydrocarbon plume migration.	• Monitored natural attenuation. • Institutional controls to protect potential future receptors.	McNab et al., 1997a
Port Hueneme Naval Construction Battalion Center, NEX Gas Station	Coastal fluvial deltaic sediments. Semi-perched unconfined aquifer. Groundwater depth is about 15 ft bgs; relatively poor quality–1,200 mg/L TDS; flow velocity is high–about 0.5 to 1.0 ft/day.	Former underground fuel piping at base service station. Approx. 11,000 gal of gasoline released from 1984–1985. Over excavation performed during tank removal and upgrade. Free product present covering an areal extent of roughly 500 × 500 ft.	Dissolved BTEX plume about 1,000 ft long; MTBE plume over 4,000 ft long, possibly extending along buried gravel stream channel.	MTBE Plume has potential to impact harbor drainage canal ecosystem.	Location of abandoned agricultural wells that may provide pathway to regional aquifer. What are appropriate risk management activities for National Test Site? What are impacts of MTBE to drainage canal marine ecosystem?	Dissolved plume BTEX concentrations are decreasing. The site is part of the National Test Site Program and the plume will be used to test various remediation technologies.	• No further action on BTEX plume. • Monitor MTBE Plume for two years for stability.	Everett et al., 1998

Table D-1. (Continued)

Site name	Hydrogeologic setting	Exposure: Primary source and residual hydrocarbons	Exposure: Potential pathways	Exposure: Potential receptors	Key issues	Risk assessment findings	Recommendations	References
Presidio at San Francisco Building 637 Area	Tidal wetland/esturine depositional sediments and fill. Approx. 750 ft from San Francisco Bay. Approx. 550 ft from proposed constructed wet lands. Depth to water about 5 ft.	Ruptured piping during 1989 Loma Prieta earthquake. Unknown quantity of diesel and gasoline released. Extensive over excavation during tank and piping removal. Currently, free product present. TPH analysis confused by high organic content of soils.	Low concentrations of BTEX components in groundwater. TPH-gasoline measured to the 100 μg/L concentration contour is about 600 ft long.	No existing receptors have been identified. Potential to impact planned constructed wetlands.	Will there be hydraulic changes during wetlands construction? Where is the benzene?	Plume stability data not available. Strong secondary evidence of passive biodegradation of petroleum hydrocarbons. High retardation due to organic rich soils. Aquitards prevent impact to regional aquifers. Any vertical migration appears to be upward. Impact on proposed constructed wetlands not likely.	• Additional monitoring to verify plume stability. • Monitored natural attenuation. • Institutional controls to protect potential future receptors.	Small et al., 1998
Travis Air Force Base North/South Gas Stations	Alluvial unconsolidated clays, silts, sands, and gravels. Clay and shale aquitards underlies the site. Depth to water about 15 ft.	Former underground fuel tanks and piping at two base service stations. Unknown quantity of gasoline released. The volume of the release is unknown. Extensive over excavation during tank removal and upgrade. Two inches of free product observed in monitoring wells near former UST at south gas station.	Only 24 months of monitoring - Plume stability data not available. Co-mingled plumes from North and South Gas Stations–600 ft long from up-gradient site, 380 ft from down-gradient site. MTBE detected in vicinity of UST locations. MTBE plume smaller than BTEX plume. Inhalation pathway analyzed.	No existing receptors have been identified.	How long plume extend before it stabilizes? What techniques can be applied to evaluate passive bioremediation potential? Are there vertical gradients and if so, which way do they flow? Time to cleanup key technical issue.	Strong secondary evidence of passive biodegradation of petroleum hydrocarbons. Estimate about 30 yr. for BTEX concentrations to reach MCLs. Aquitards prevent impact to regional aquifers; any vertical migration appears to be upward. Inhalation exposure is not a concern.	• Installation of two down gradient sentry wells. • Additional monitoring to verify plume stability. • Monitored natural attenuation. • Institutional controls to protect potential future receptors.	McNab et al., 1997b

Table D-1. (Continued)

Site name	Hydrogeologic setting	Exposure: Primary source and residual hydrocarbons	Exposure: Potential pathways	Exposure: Potential receptors	Key issues	Risk assessment findings	Recommendations	References
Vandenberg Air Force Base Exchange Gas Station	Uplifted marine terrace consisting of layers of sand and clay. Shallow perched saturated zone, 15 ft thick, sits on fat clay layer. Sampling to 60 ft below this layer indicate unsaturated conditions. Depth to top of perched groundwater is seasonally variable. Depth to regional groundwater is 450 ft. Perched groundwater of relatively poor quality—About 1,100 mg/L TDS.	Former underground fuel tanks and piping at base service station. Estimated 2,300 gal of gasoline released over unknown period of time. Over excavation performed during tank removal. Hydrocarbon sheen noted in some vadose zone samples.	Dissolved BTEX and MTBE groundwater plumes are less than about 300 ft long.	No existing receptors have been identified. Nearest groundwater basin being used is 3 miles away.	What are beneficial uses of perched, low yield aquifer created by lawn irrigation and car wash? What is the time frame for anticipated use, if ever, for perched aquifer?	Strong secondary evidence of passive biodegradation of petroleum hydrocarbon compounds. Evidence of plume capture by transpiration of nearby eucalyptus trees. Aquitards prevent impact to regional aquifers. Existing 14 extraction well field yields combined yield of about 2 gal/min; pump and treat remedial alternative is impractical. MTBE Plume overlaps BTEX plume; MTBE plume expected to detach from BTEX plume. MTBE plume expected to stabilize through dispersion.	• Monitored natural attenuation with possible phytoremediation. • Removing sources of perched aquifer recharge allowing aquifer to dewater.	McNab et al., 1998b

D-2. References

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